INTERCITY DOUBLE-DECK COACH DEMONSTRATION 1982: 3-AXLE NEOPLAN SKYLINER

BY

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17. Abstract

The results of a service demonstration of the Neoplan double-deck Skyliner N122/3 coach carried out by Pacific Coach Lines Ltd. (PCL) are presented. The objective of the service demonstration was to ascertain the technical merits of operating a double-deck coach on selected PCL routes.

The coach was borrowed from NEOPLAN-USA/Rolf Ruppenthal and Associates Ltd. in January 1982 and operated on regular service from 20 January to 29 January, 1982.

In general, PCL was pleased with the results of the service demonstration. The Neoplan Double-Deck coach appears to offer significant economic and technical advantages over conventional intercity coaches.

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17. Résumé

Ce rapport présente les résultats de la mise en service expérimentale d'un autocar à impériale Skyliner N122/3 de marque Neoplan par la Pacific Coach Lines Ltd. (PCL). Cet essai avait pour objet de déterminer les avantages techniques de l'exploitation d'un véhicule de ce type sur des itinéraires choisis de la PCL.

Le véhicule de l'essai, qui avait été emprunté de Neoplan USA/Rolf Ruppenthal and Associates Ltd., en janvier 1982, a été mis en service régulier entre le 20 et le 29 du même mois.

PCL se dit généralement satisfait des résultats de l'expérience, l'autocar à impériale Neoplan ayant affiché une nette supériorité technico-économique sur les autocars courants.

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1.0 INTRODUCTION

1.1 BACKGROUND

1.1.1 Pacific Coach Lines Ltd.

Pacific Coach Lines Ltd. (PCL) was incorporated on August 2, 1978. PCL was inactive until August 31, 1978 when it acquired the assets and assumed the liabilities of Vancouver Island Transportation Co. Ltd. and commenced operations on Vancouver Island. As of April 1, 1979, PCL acquired certain operating assets and assumed the operating responsibilities of Pacific Stage Lines, a division of B.C. Hydro and Power Authority, which operated the interurban motorcoach services between Vancouver and Vancouver Island and from Vancouver throughout the Fraser Valley. The decision to merge Vancouver Island Transportation and Pacific Stage lines was based on a task force report to the B.C. Government and B.C. Hydro Board, which indicated an opportunity to realize significant economies through a merger.

Based on the combined operating deficits of the two separate entities for fiscal year 1977/78, direct operating costs have dropped as a result of the merger. Despite the increasing costs of extra services in carrying more people, significant economies through effective and prudent control of costs and improved matching of capacity to demand have been achieved.

Nevertheless, PCL continues to operate with a deficit. The transportion of passengers by motorcoach is a labour intensive business. Fully 63% of PCL's total operating costs are accounted for in wages, salaries and wage-related benefits. Additionally, an aging fleet of motorcoaches and correlated high maintenance costs per passenger-mile suggest that PCL will continue to operate with a deficit.

Capital expenditures are expected to remain high as PCL continues to improve its quality of service. Its active fleet of about 120 coaches are being reidentified on a basis of pre-programmed need for

refurbishment/replacement. PCL terminals are being upgraded including planned relocation or up-grading of terminals in Victoria, Nanaimo, Vancouver and in some Fraser Valley communities within the Lower Mainland System.

1.1.2 Equipment Options

In order to accomplish PCL objectives of economic and efficient motorcoach operations within its intercity boundaries, it is critical that direct operating costs be significantly lowered and that its fleet of motorcoaches better service the demand from its routes.

In view of these objectives, PCL's traffic management has been studying the feasibility of introducing high capacity intercity coaches into their fleet. Such coaches could carry up to twice the number of passengers handled by the present fleet at comparable operating costs. The studies suggest that PCL could reduce operating costs by introducing high capacity intercity coaches on selected routes or alternatively introducing a shuttle service for the Victoria-Vancouver intermodal route.

It was concluded that a full shuttle system would provide the best solution to PCL's capacity problem, would have the lowest direct operating costs, but would provide the least passenger convenience. The cost advantages would be eroded dramatically when the cost of baggage "pups" and the cost of pick-up/drop-off terminals are included. Even with these facilities, this system, while technically feasible, would be inconvenient for passengers, and would present difficult scheduling problems for the operator due to the directional flow of traffic.

A semi-shuttle system with a fraction of the coaches operating as shuttles and the remainder carrying all the luggage and boarding the ferries for the complete journey would improve the current capacity problem. However, after adding terminal costs, it would likely cost as much as the existing system and present additional customer confusion and operator scheduling problems.

A system operating as at present but with a full complement of double-deck high capacity coaches would provide all the conveniences of the existing system and perhaps at lower cost in the long run (depending on the cost and feasibility of coach conversion for baggage handling). Double-deck coaches would also increase the passenger capacity of the present system by about 50% with 12 m coaches and up to 100% with 15 m coaches.

A mixed fleet of double-deck coaches and standard coaches was recommended as the best overall solution. Using a limited fleet of double-deck coaches operating full time to provide the base off-season service and then rescheduling to meet peak capacity in the rush hours of the peak season with the base service provided by standard coaches is considered the ideal application for high capacity coaches. The mixed fleet concept would provide all the convenience of the existing system and, based on preliminary costing appears to be the second least expensive system to operate, and may prove to be the least expensive overall with all costs included.

Availability of suitable double-deck coaches presents several problems: the equipment is currently not manufactured in Canada and non-Canadian double-deck coaches are very expensive, with modifications adding to their cost.

1.2 PCL DOUBLE-DECK BUS TRIAL - 1982

PCL is currently considering the procurement of double-deck coaches. In order to assess the technical feasibility of operating a double-deck coach on selected PCL routes, it was decided that a short duration trial be carried out using a Neoplan Double-Deck Skyliner N122/3 coach. The coach was borrowed from NEOPLAN-USA/Rolf Ruppenthal & Associates in January 1982 and operated on regular service from 20 January to 29 January 1982.

1.3 TRIAL OBJECTIVES

1.3.1 Overall Objective

The overall objective of the PCL double-deck coach trial was to ascertain the relative technical merits of operating a double-deck coach on selected PCL routes.

1.3.2 Trial Objectives

The objectives of the trial were:

- o to familiarize PCL with the operation of double-deck coaches.
- o to determine the technical limitations of the implementation of double-deck coach service on selected PCL routes.
- o to estimate the operating costs of double-deck coach service.
- o to establish possible equipment configurations for double-deck coaches.
- o to assess the merits of the NEOPLAN double-deck Skyliner coach.

2.0 DOUBLE-DECK INTERCITY COACH SERVICE DEMONSTRATION

2.1 12m DOUBLE-DECK COACH

The NEOPLAN Double-Deck Skyliner N122/3 coach borrowed from NEOPLAN-U.S.A./Rolf Ruppenthal & Associates for the purpose of the 1982 trial was equipped with a Detroit Diesel 8V92TAC engine and Allison HT740 transmission. Other modifications to the coach from its original european format have been performed by NEOPLAN-U.S.A. in order to meet Federal Motor Vehicle Safety Standards. The seating configuration and interior layout of the coach are shown in the plans presented in Appendix A and Appendix B. Seating capacity was limited to 72 i.e., 52 seats in the lower level and 20 passengers seated in the upper level. The lower level also includes a washroom and galley. The double-deck coach had decals in PCL's colours including the PCL logo applied to the front and rear of the vehicle.

2.2 ROUTE SELECTION

Traffic Management selected routes that would provide PCL with sufficient experience during the relatively short duration of the trial to:

- identify problems associated with possible implementation of the coach on regular revenue operation;
- assess passenger demand and acceptance;
- provide maximum exposure of the possible new service to passengers;
- assess maintenance requirements for the coach.

The routes selected were as follows:

- Victoria - Nanaimo - Campbell River
- Victoria - Vancouver
- Vancouver - Mission
- Vancouver - Chilliwack

2.3 DEMONSTRATION SCHEDULE

The schedule of the demonstration is shown in Figure 2.1.

Each route selected for the demonstration consists of ex-depot passengers with pick-up/drop-off on route.

2.4 MAINTENANCE FACILITIES

The double-deck coach was maintained by PCL's maintenance personnel throughout the demonstration. Special facilities were not provided for maintenance of the double-deck coach nor were special tools or devices provided by NEOPLAN to assist PCL in maintenance of the coach. Spare parts were not available for the coach.

2.5 TERMINAL FACILITIES

In view of the height of the double-deck coach, some concern was expressed regarding possible damage to either terminal or coach during loading and docking operations. Preliminary investigation by PCL of the clearance available at terminals showed that the double-deck would have minimal clearance underneath the passenger loading canopies at Nanaimo and Vancouver, and would not fit at any other terminal. In view of PCL's desire to renovate and re-model its terminals, this was not considered to be a serious detriment to the introduction of double-deck coaches into PCL's operation. Specifically in relation to this two week trial it was felt that PCL could manage and operate the double-deck coach without significant inconvenience to its passengers.

2.6 DRIVER TRAINING

In view of the relatively short duration of the trial, PCL was not able to implement an extensive driver training program. It was decided that that a brief familiarization tour of the coach would be sufficient for safe and effective operation of the double-deck coach during the service demonstration.

TABLE 2.1: 1982 DOUBLE-DECK COACH DEMONSTRATION SCHEDULE

WEDNESDAY 20 JANUARY			
7:50 am - Victoria		Nanaimo	- 9:50 am
10:40 am - Nanaimo		Campbell River	- 1:10 pm
2:00 pm - Campbell River		Nanaimo	- 4:30 pm
5:00 pm - Nanaimo		Victoria	- 7:00 pm
THURSDAY 21 JANUARY			
8:00 am - Victoria		Vancouver	- 11:30 am
4:35 pm - Vancouver		Abbotsford	- 8:50 pm
FRIDAY 22 JANUARY			
deadhead - Abbotsford		Vancouver	
8:00 pm - Vancouver		Victoria	- 11:30 pm
MONDAY 25 JANUARY			
10:00 am - Victoria		Vancouver	- 1:30 pm
2:00 pm - Vancouver		Victoria	- 5:30 pm
TUESDAY 26 JANUARY			
8:00 am - Victoria		Vancouver	- 11:30 am
WEDNESDAY 27 JANUARY			
4:35 pm - Vancouver		Mission	- 6:20 pm
THURSDAY 28 JANUARY			
5:50 am - Mission		Vancouver	- 7:40 am
8:00 am - Vancouver		Victoria	- 11:30 am
12:00 am - Victoria		Vancouver	- 3:30 pm
4:35 pm - Vancouver		Chilliwack	- 6:20 pm
FRIDAY 29 JANUARY			
5:45 am - Chilliwack		Vancouver	- 7:30 am
9:35 am - Vancouver		Chilliwack	- 11:45 am
1:00 pm - Chilliwack		Vancouver	- 3:20 pm
3:35 pm - Vancouver		Abbotsford	- 4:55 pm

2.7 INFORMATION REPORTING SYSTEM

PCL made extensive use of its existing information reporting system to record all maintenance actions, fuel and lubricant requirements, passenger demand and driver reactions during the course of the service demonstration.

2.8 TECHNICAL AND OPERATIONAL EVALUATION OF DOUBLE-DECK COACH

On conclusion of the service trial all personnel who had taken part or were effected by the operation of the NEOPLAN double-deck coach were interviewed by PCL's traffic management. The purpose of these interviews was to determine the technical and operational merits and deficiencies associated with the NEOPLAN Skyliner N122/3 coach opertaing on the selected PCL routes. In addition to the immediate reporting of results from the trial, Hickling-Partners Inc. also interviewed traffic management personnel, dispatch personnel, drivers and mechanics within the PCL system. The result of this evaluation is included in section 3.0 of this report.

3.0 1982 DOUBLE-DECK INTERCITY COACH SERVICE DEMONSTRATION - RESULTS

3.1 PASSENGER DEMAND

The number of passengers carried by the double-deck coach during the service demonstration is presented in Figure 3.1 as ex-depot and total passengers carried. Ex-depot passengers are those who boarded the coach at the terminal. The total passenger loading provided includes both ex-depot passengers and passengers who board the coach in route. On the intermodal runs of Victoria-Vancouver and Nanaimo-Vancouver, most pick-ups occurred on board the ferry. It will be noted that on numerous runs the coach left the terminal with a complement of passengers who could have been fully accommodated by a normal 49-seat coach. However when departing the ferry the number of passengers far exceeded the capabilities of a normal 49-seat coach, but were fully accommodated by the double-deck coach. Under normal operation PCL on such departures would have had a 49-seat coach deadhead to the ferry terminal to pick up those passengers who would have been boarding on the ferry. Thus 49-seat coaches would have been used as passenger pups on board the ferry. Of the seven departures for which the double-deck coach had been used on the intermodal route, six resulted in a saving of extra sections. This is a very significant saving and clearly shows the advantages of operating high capacity coaches on those routes where demand warrants.

During the course of the double-deck demonstration PCL staff interviewed passengers on board the vehicle. The general conclusion was that passengers readily accepted the double-deck configuration and were most pleased with comfort and visibility offered by the double-deck coach. Some complaints however were noted for the relatively poor access to the upper level of the double-deck coach. The steps leading to the upper level were quite steep and a portion of the final step intrudes into the upper level aisle, thereby creating a hazardous situation for passengers disembarking, embarking or using the washroom facilities at the lower

FIGURE 3.1: PASSENGER UTILIZATION DURING PCL SERVICE DEMONSTRATION

DATE	DEPARTURE	ROUTE	DRIVER	MILEAGE (km)	PASSENGER COUNT	
					EX-DEPOT	TOTAL
20 Jan.	7:50 A	Victoria-Nanaimo	Skinner	122	17	25
	10:40 A	Nanaimo-Campbell R.	Hardy	146	13	13
	2:00 P	Campbell R-Nanaimo	MacDonald	146	5	15
	5:30 P	Nanaimo-Victoria	Reid	122	22	31
21 Jan.	8:00 A	Victoria-Vancouver	Whitehouse	68	41	71
	4:35 P	Vancouver-Abbotsford	Mulholland	77	53	70
22 Jan.	Non-scheduled	Abbotsford-Vancouver	Scaglo (Neoplan)	77	Deadhead	--
	8:00 P	Vancouver-Victoria	Nicholson	68	17	40
25 Jan.	10:00 A	Victoria-Vancouver	Myhre	68	43	63
	2:00 P	Vancouver-Victoria	Bienom	68	57	65
26 Jan.	8:00 A	Victoria-Vancouver	Whitehouse	68	38	58
27 Jan.	4:35 P	Vancouver-Mission	Fallan	77	49	69
28 Jan.	5:50 A	Mission-Vancouver	Harold	77	39	49
	8:00 A	Vancouver-Victoria	Armstrong	68	47	54
	12:00 Noon	Victoria-Vancouver	Armstrong	68	57	69
	4:35 P	Vancouver-Chilliwack	Mulholland	108	12	59
29 Jan.	5:45 A	Chilliwack-Vancouver	Swanson	108	36	46
	9:35 A	Vancouver-Chilliwack	Harma	108	31	51
	1:00 P	Chilliwack-Vancouver	Freiss	108	41	46
	3:35 P*	Vancouver-Abbotsford	Robinson	77	19	44

* Coach returned to NEOPLAN USA on completion of Vancouver-Abbotsford trip.

level. Although it was expected that some complaint would be registered about the time required to load and unload the coach, this was not the case. The only other major complaint expressed by most passengers was the poor heating and ventilating system on the NEOPLAN double-deck. This problem was also reported by maintenance personnel.

3.2 FUEL CONSUMPTION RATE

Fuel consumption of the Neoplan Skyline N122/3 coach was monitored throughout the service demonstration. Total trip mileage is reported as 1820 kilometres. Fuel consumption was found to be 209.8 gallons (953.8 l) thereby giving an average fuel consumption rate of 5.39 miles per gallon (52.4 l per 100 km). This value compares favourably with PCL's conventional fleet average of 5.5 miles per gallon (51.4 l per 100 km) when related to the increased passenger capacity.

3.3 PCL MAINTENANCE

3.3.1 Maintenance Actions

Maintenance actions reported during the revenue service demonstration are included in Appendix C. Two maintenance actions are reported. The first occurred on 21st January 1982 when the fan idler shaft and pulley were damaged and repaired. The total cost to effect repair was $848.97 to PCL. The second maintenance action occurred 26 January 1982. An exhaust pipe was removed and repaired. Marker lights and the lower and upper-deck windshield wipers were repaired. The failure of the exhaust pipe occurred while the double-deck coach was loading onto the ferry. The ramp was improperly set by ferry personnel and the coach bottomed on to the ramp. The failure of the windshield wipers unfortunately occurred during a rain storm in the Fraser Valley. This created a serious hazard. The coach was delivered to the Vancouver garage to effect immediate repair. However, since no electrical schematics were available from NEOPLAN to assist PCL in effecting repair, PCL managed to shortcircuit the electronics of the wiper control system such that the wipers would operate effectively throughout the remainder of the service demonstration.

Subsequent discussions with NEOPLAN- USA regarding the coach indicated that no other maintenance actions were carried out after return of the vehicle to Neoplan.

3.3.2 Maintenance of the Double-Deck Coach

In view of the short duration of the demonstration, it was not possible to estimate in cost per mile or per passenger mile or in any other terms, the maintenance costs associated with the NEOPLAN double-deck N122/3 coach.

Maintenance personnel at PCL had an opportunity to examine the NEOPLAN double deck coach throughout the two-week demonstration. It was reported that the braking system was very well balanced. The coach rode exceptionally well. The suspension system had proven to be very good and offered excellent control for the driver. A major flaw, however, lay with the heating system. The system is expected to require excessive maintenance. The electrical system is considered to be complicated with too many controls and adjustments to provide for effective maintenance.

The marginal ground clearance provided by the present double deck coach is considered to be detrimental to the introduction to this type of coach on PCL's main routes where intermodal transportation takes place. This was witnessed in the failure of the coach to negotiate a slightly misplaced ramp.

It was also expressed by the maintenance personnel that a second level service would be appropriate for the double-deck. At present there are no built-in lights or extension cords which are available to facilitate maintenance in the second level. An electrical receptical is required such that either power could be provided to the lights or power could be provided for extension cords to effect maintenance or cleaning of the upper level of the double-deck.

The power generated by the Detroit diesel engine was fully satisfactory and the automatic transmission was considered to be excellent. However, accessories powered by the engine are belt driven and short-coupled. This results in failed bearings as was witnessed in the fan idler failure maintenance action reported earlier.

The rear service door was a fibreglass single piece unit deemed to be very expensive to repair.

The radiator filler cap is located in the luggage compartment.

3.4 DRIVER COMMENTS

The drivers who operated the double-deck coach during the service demonstration were interviewed by traffic management at PCL and by Hickling-Partners Inc.

Drivability was considered to be very good for the double deck coach; the suspension system was a significant improvement over standard 49 seat coaches now in operation with PCL.

The luggage compartment offered by the double-deck coach was considered to be totally inadequate. It provided insufficient space for luggage and was elevated, therefore requiring that the drivers lift luggage a considerable height.

Visibility was considered to be very good and no improvements were suggested.

The passenger aisle was considered to be too narrow and the upper level aisle, which suffer from an intrusion of steps, considered to be a safety problem.

The major concern of the drivers was the potential lack of security on the upper level of the double-deck coach. They felt they could not monitor the activities of passengers travelling on the upper level and therefore felt they could not guarantee total security to their clients.

Drivers did however bring to the attention of PCL traffic management that although the overall height of the double deck coach was not a problem on most of the routes travelled by PCL, some concern was raised regarding the old standard lights located in Victoria. The curb height of some of these lights is less than 13½ feet: 13.5 feet being the total height of the double-deck coach. Thus the selection of an appropriate route and a driver and route training program would be required if double-deck coaches were to be introduced to PCL.

Drivers were also requested to comment upon special needs. They stated that the NEOPLAN double-deck coach offered easy egress and ingress to the lower level, but poor access to the upper level. Special needs could be serviced with the lower level. The lower level was, during the two week trial, well received by those passengers requiring special needs.

3.5 TECHNICAL AND OPERATIONAL EVALUATION

The general passenger acceptance of the ride qualities and comfort and convenience features of the NEOPLAN double deck-coach was exceptionally high as was the acceptance level by drivers as far as ride quality, steering, braking, engine performance and stability were concerned. However, the inaccessibility of the engine and transmission for maintenance, the heating and ventilation system and some areas of interior design of the Neoplan coach were unsatisfactory.

The results of PCL's technical and operational evaluation of the Neoplan double-deck coach were used to generate a Double-Deck Coach Specification.

3.6 ECONOMIC MODEL

In order to assess the applicability of the double-deck mixed fleet for PCL, additional analyses were carried out using Incremental Demand Cost Analysis Model. The Model is detailed in "A Feasibility Study of the Introduction of Larger Capacity Intercity Buses" by ND. Lea and Associates Ltd., TDC TP 2053.

Using the operating costs of PCL for 1981, we obtain the following basic inputs.

o Driver costs (wages and benefits)	$1.891/mile
o Dispatch costs	$0.125/mile
o Ferry tolls (Vancouver-Victoria-Nanaimo intermodal routes only)	$3.330/mile
o Maintenance	$1.104/mile
o Terminal (wages and benefits)	$0.666/mile
o Facilities	$0.372/mile
o General and Administration	$0.398/mile

The results from the BIG Bus Model are included in Appendix D. It was assumed that maintenance costs for the double-deck coach would exceed that of a normal 49 seat coach by 10%. This is considered to be a reasonable estimate and may, in PCL's case, be lower because of the present mean age of their standard fleet. Ferry charges are included with the driver wages for intermodal routes only.

Load factors are based on the total number of passengers carried in each month of 1981 and averaged to the number of departures scheduled for each month.

The O&M cost savings predicted for the intermodal Victoria-Vancouver route for 1981 is estimated to be $950,000 as shown in Figure 3.2 if 72 passenger double-deck coaches were to replace conventional 49 passenger coaches on scheduled departures. It is estimated that eighteen (18) double-deck coaches are required to achieve this saving on the Victoria-Vancouver intermodal route. The quantity of coaches identified will satisfy the number of scheduled peak season departures (summer) and also provide for a 12.5% equipment standby capability. The standby capability is required to assure 100% availability of double-deck coaches on the selected route.

FIGURE 3.2: VICTORIA-VANCOUVER INTERMODEL ROUTE INCREMENTAL DEMAND COST ANALYSIS MODEL RESULTS

MONTH	LOAD FACTOR	# PASS MONTHLY	O & M COST SAVING PER PASS MILE	TOTAL O&M COST SAVING (PASS x REVENUE x 42 MILES)
February	84.8	41,268	(.001)	$ (1,733)
March	101.16	49,229	.076	$157,139
April	126.55	61,586	.061	$157,783
May	138.02	67,168	.056	$157,979
June	106.2	64,598	.072	$195,344
July	92.72	90,629	(.002)	$ (7,613)
August	96.17	93,588	(.002)	$ (7,861)
September	93.61	68,326	(.002)	$ (5,739)
October	106.11	51,640	.072	$156,159
November	85.84	41,768	(.003)	$ (5,236)
December	99.49	48,418	.077	$156,584
January	85.44	41,583	(.003)	$ (5,239)
ESTIMATED ANNUAL O&M COST SAVINGS				$947,540

3.7 DOUBLE-DECK AND ARTICULATED COACHES

In order to reaffirm the level of difference between maintenance of the NEOPLAN articulated coach during the Voyageur Enterprises Ltd. revenue service demonstration and the two week demonstration of the Neoplan double-deck, the maintenance labour content associated with each in keeping the test vehicles in service is compared. It is reported that the double-deck NEOPLAN operating on the PCL demontration required 63% less labour per mile to keep the vehicle operating than Voyageur required to keep its articulated coach in operation. This value is based on maintenance labour required by Voyageur during the only period in which the articulated coach experienced no major failures. The problems associated with the articulated coach required that Voyageur spend considerable more effort to maintain its coach in service.

Results from the Neoplan Articulated Coach Revenue Service demonstration are presented in Figure 3.2. Standard MCI 47 seat coaches were reported to have an average fuel consumption rate of 6.07 mpg (46.5 l per 100 km) while the Neoplan Articulated coach obtained 4.62 mpg (61.1 l per 100 km). By comparing the fuel required to operate the three classes of coaches (gallons of fuel per thousand miles per seat), we note that the Neoplan double-deck is significantly lower than either that of a standard coach or Neoplan articulated coach. In particular, we note that no direct savings in fuel cost can be attributed to the articulated coach even though it is classed as a high capacity coach, whereas the double-deck coach attained significantly lower fuel costs.

FIGURE 3.3: FUEL CONSUMPTION RATE COMPARISON

	SEATING CAPACITY	AVERAGE TRIP FUEL CONSUMPTION mpg.	FUEL PER THOUSAND SEAT-MILES gal
MCI - STANDARD	47	6.07	3.51
NEOPLAN - ARTICULATED	61	4.62	3.55
NEOPLAN - DOUBLE-DECK N122/3	72	5.39	2.58

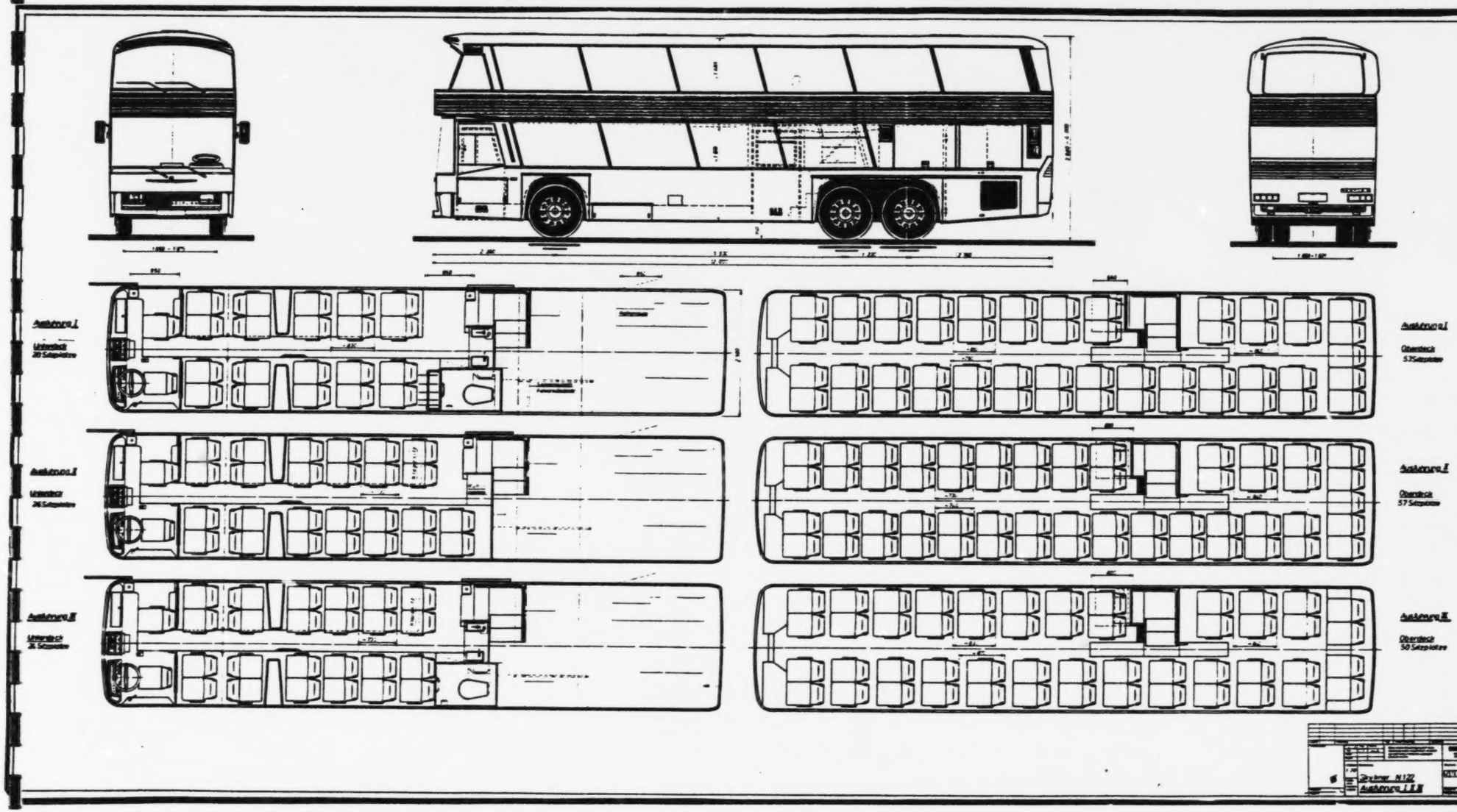
4.0 CONCLUSIONS

In general, PCL staff were pleased with the results of the 1982 double-deck trial. PCL was afforded an opportunity to evaluate this new equipment under conditions more appropriate to its operation rather than under controlled test circumstances. It can also be said that in comparing the operation maintenance and technical demands of the double-deck coach with those of the articulated coach, the double-deck coach appears to be superior in reduced O&M costs, technical complexity, maintenance actions, drivability and safety. The experience of Voyageur Enterprises Ltd. with the articulated coach were less than pleasant in that the coach suffered from major structural and mechanical failures that caused the revenue service demonstration to be terminated early. Voyageur could no longer support, operate or maintain the NEOPLAN articulated coach on regular revenue service. However, PCL in its experience with the NEOPLAN double-deck coach found that although some flaws exist with Neoplan double-deck coach, there were no major problems which would have caused early ending of the service demonstration. The double-deck coach was simpler to operate and maintain, offered much improved passenger and driver acceptance, and a significantly higher availability over the articulated coach.

PCL has concluded that articulated coaches probably will not be used on any of their intercity routes since the economic and technical advantages that are available over normal 49 seat coaches are limited to increase freight carrying capacity whereas significant economic and technical advantages are expected to occur from an improved double-deck coach.

APPENDIX A

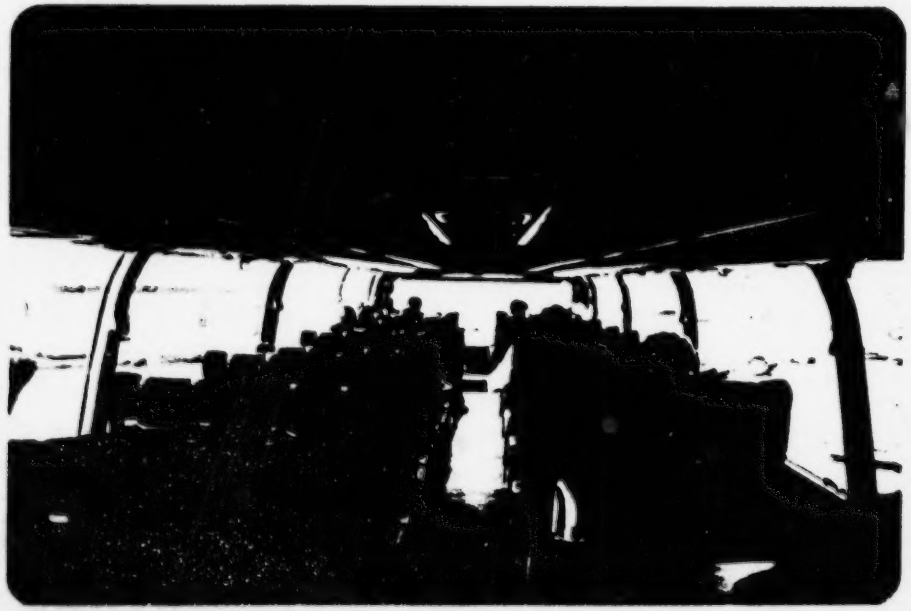
TYPICAL INTERIOR PLAN OF SKYLINE DOUBLE-DECK COACHES



APPENDIX B

PORTFOLIO OF PHOTOGRAPHS OF THE PCL/NEOPLAN DOUBLE-DECK N122/3 COACH

Pacific Coach Lines
PCL
PCL



APPENDIX C

PCL DOUBLE-DECK COACH MAINTENANCE ACTIONS

Pacific Coach Lines Ltd.

WORK ORDER
№ 3475

DATE ISSUED	WORK STARTED	WORK COMPLETED	MILEAGE	COACH NUMBER
22 / 1 / 82	/ /	/ /		NEOPLAN
DAY MONTH YEAR	DAY MONTH YEAR	DAY MONTH YEAR		

WORK DESCRIPTION	CODE
21-1-82 FAN IDLER SHAFT & PULLEY DAMAGED (SUBLET)	008

MECHANIC	CODE ▶	008
[illegible]		4.30
[illegible]		1.00
[illegible]		.30
[illegible]		2.00
[illegible]		4.30
4 [illegible]	TOTALS / C'FD	584.00

WORK ORDER NUMBER 3473

COACH NUMBER NEOPLAN

B'FD 008

PART NUMBER	DESCRIPTION	QTY	UNIT PRICE		CODE

Pacific Coach Lines Ltd.

WORK ORDER
№ 3492

DATE ISSUED	WORK STARTED	WORK COMPLETED	MILEAGE	COACH NUMBER
28/01/82 DAY MONTH YEAR	/ / DAY MONTH YEAR	/ / DAY MONTH YEAR		N-6P 1128

WORK DESCRIPTION	CODE
ALTER EXHAUST PIPE REMOVE & REPLACE (NEW PARTS)	MAY
ALTER REPLACE BLOWS & trouble shoot upper deck W/S wipers (no schematics to follow)	"

MECHANIC CODE ▶	M.T	C.G									
[illegible]	1.30										
[illegible]		1.30									
[illegible]		1.30									
[illegible]	1.00										
TOTALS / C'FD	95:2	114.									

WORK ORDER NUMBER

COACH NUMBER

PART NUMBER	DESCRIPTION	QTY	B'FD UNIT PRICE				CODE
	BRACE	2	1	00	2	00	
	ARM	1	1	00	1	00	

APPENDIX D

BIG BUS MODEL - PCL DOUBLE-DECK OPERATIONS, INTERMODAL AND NON-FERRY ROUTES

[redacted] BUS COST ESTIMATING MODEL

BASELINE BUS
[redacted] SEATING CAPACITY.... 49 BUS $/MI..... 1.104
[redacted]VER $/ML..... 1.891 OVERHEAD $/ML.... 1.561
SCENARIO :NON-FERRY ROUTES POL 1981
1ST UNIT SEATING CAPACITY.... 72 2ND UNIT SEATING CAPACITY.... 49
1[redacted] BUS $/ML..... 1.214 2ND BUS $/MI..... 1.104
1ST DRIVER $/MI..... 1.891 2ND DRIVER $/MI..... 1.891
OVERHEAD $/ML..... 1.561

PASS	BASE	TEST	DIFF	%	PASS	BASE	TEST	DIFF	%	PASS	BASE	TEST	DIFF	%
[redacted]	4.556	4.666	0.110	2	51	0.179	0.091	0.087-	49-	101	0.135	0.091	0.044-	33-
[redacted]	2.278	2.333	0.055	2	52	0.175	0.090	0.086-	49-	102	0.134	0.090	0.044-	33-
3	1.519	1.555	0.037	2	53	0.172	0.088	0.084-	49-	103	0.133	0.090	0.043-	33-
[redacted]	1.139	1.167	0.028	2	54	0.169	0.086	0.082-	49-	104	0.131	0.089	0.043-	33-
[redacted]	0.911	0.933	0.022	2	55	0.166	0.085	0.081-	49-	105	0.130	0.088	0.042-	33-
[redacted]	0.759	0.778	0.018	2	56	0.163	0.083	0.079-	49-	106	0.129	0.087	0.042-	33-
7	0.651	0.667	0.016	2	57	0.160	0.082	0.078-	49-	107	0.128	0.086	0.042-	33-
[redacted]	0.569	0.583	0.014	2	58	0.157	0.080	0.077-	49-	108	0.127	0.085	0.041-	33-
[redacted]	0.506	0.518	0.012	2	59	0.154	0.079	0.075-	49-	109	0.125	0.085	0.041-	33-
10	0.456	0.467	0.011	2	60	0.152	0.078	0.074-	49-	110	0.124	0.084	0.040-	33-
[redacted]	0.414	0.424	0.010	2	61	0.149	0.076	0.073-	49-	111	0.123	0.083	0.040-	33-
[redacted]	0.380	0.389	0.009	2	62	0.147	0.075	0.072-	49-	112	0.122	0.082	0.040-	33-
13	0.350	0.359	0.008	2	63	0.145	0.074	0.071-	49-	113	0.121	0.082	0.039-	33-
[redacted]	0.325	0.333	0.008	2	64	0.142	0.073	0.069-	49-	114	0.120	0.081	0.039-	33-
[redacted]	0.304	0.311	0.007	2	65	0.140	0.072	0.068-	49-	115	0.119	0.080	0.039-	33-
[redacted]	0.285	0.292	0.007	2	66	0.138	0.071	0.067-	49-	116	0.118	0.080	0.038-	33-
17	0.268	0.274	0.006	2	67	0.136	0.070	0.066-	49-	117	0.117	0.079	0.038-	33-
[redacted]	0.253	0.259	0.006	2	68	0.134	0.069	0.065-	49-	118	0.116	0.078	0.038-	33-
[redacted]	0.240	0.246	0.006	2	69	0.132	0.068	0.064-	49-	119	0.115	0.077	0.037-	33-
20	0.228	0.233	0.005	2	70	0.130	0.067	0.064-	49-	120	0.114	0.077	0.037-	33-
[redacted]	0.217	0.222	0.005	2	71	0.128	0.066	0.063-	49-	121	0.113	0.076	0.037-	33-
[redacted]	0.207	0.212	0.005	2	72	0.127	0.065	0.062-	49-	122	0.112	0.113	0.001	1
23	0.198	0.203	0.005	2	73	0.125	0.126	0.002	1	123	0.111	0.112	0.001	1
[redacted]	0.190	0.194	0.005	2	74	0.123	0.125	0.001	1	124	0.110	0.111	0.001	1
[redacted]	0.182	0.187	0.004	2	75	0.121	0.123	0.001	1	125	0.109	0.110	0.001	1
[redacted]	0.175	0.179	0.004	2	76	0.120	0.121	0.001	1	126	0.108	0.109	0.001	1
27	0.169	0.173	0.004	2	77	0.118	0.120	0.001	1	127	0.108	0.108	0.001	1
[redacted]	0.163	0.167	0.004	2	78	0.117	0.118	0.001	1	128	0.107	0.108	0.001	1
[redacted]	0.157	0.161	0.004	2	79	0.115	0.117	0.001	1	129	0.106	0.107	0.001	1
30	0.152	0.156	0.004	2	80	0.114	0.115	0.001	1	130	0.105	0.106	0.001	1
[redacted]	0.147	0.151	0.004	2	81	0.112	0.114	0.001	1	131	0.104	0.105	0.001	1
[redacted]	0.142	0.146	0.003	2	82	0.111	0.112	0.001	1	132	0.104	0.104	0.001	1
33	0.138	0.141	0.003	2	83	0.110	0.111	0.001	1	133	0.103	0.104	0.001	1
34	0.134	0.137	0.003	2	84	0.108	0.110	0.001	1	134	0.102	0.103	0.001	1
[redacted]	0.130	0.133	0.003	2	85	0.107	0.108	0.001	1	135	0.101	0.102	0.001	1
[redacted]	0.127	0.130	0.003	2	86	0.106	0.107	0.001	1	136	0.100	0.101	0.001	1
37	0.123	0.126	0.003	2	87	0.105	0.106	0.001	1	137	0.100	0.101	0.001	1
[redacted]	0.120	0.123	0.003	2	88	0.104	0.105	0.001	1	138	0.099	0.100	0.001	1
[redacted]	0.117	0.120	0.003	2	89	0.102	0.104	0.001	1	139	0.098	0.099	0.001	1
40	0.114	0.117	0.003	2	90	0.101	0.102	0.001	1	140	0.098	0.098	0.001	1
[redacted]	0.111	0.114	0.003	2	91	0.100	0.101	0.001	1	141	0.097	0.098	0.001	1
[redacted]	0.108	0.111	0.003	2	92	0.099	0.100	0.001	1	142	0.096	0.097	0.001	1
[redacted]	0.106	0.109	0.003	2	93	0.098	0.099	0.001	1	143	0.096	0.096	0.001	1
[redacted]	0.104	0.106	0.002	2	94	0.097	0.098	0.001	1	144	0.095	0.096	0.001	1
[redacted]	0.101	0.104	0.002	2	95	0.096	0.097	0.001	1	145	0.094	0.095	0.001	1
[redacted]	0.099	0.101	0.002	2	96	0.095	0.096	0.001	1	146	0.094	0.094	0.001	1
[redacted]	0.097	0.099	0.002	2	97	0.094	0.095	0.001	1	147	0.093	0.094	0.001	1
[redacted]	0.095	0.097	0.002	2	98	0.093	0.094	0.001	1	148	0.123	0.093	0.030-	24-
[redacted]	0.093	0.095	0.002	2	99	0.138	0.093	0.045-	33-	149	0.122	0.092	0.030-	24-
[redacted]	0.141	0.093	0.048-	34-	100	0.137	0.092	0.044-	33-	150	0.121	0.092	0.030-	24-

BUS COST ESTIMATING MODEL

BASELINE BUS
UNIT SEATING CAPACITY.... 49 BUS $/MI..... 1.104
DRIVER $/MI..... 5.221 OVERHEAD $/MI..... 1.561
SCENARIO :VANCOUVER/VICTORIA PCL 1981
UNIT SEATING CAPACITY.... 72 BUS $/MI..... 1.214
DRIVER $/MI..... 5.221 OVERHEAD $/MI..... 1.561

PASS	BASE	TEST	DIFF	%	PASS	BASE	TEST	DIFF	%	PASS	BASE	TEST	DIFF	%
1	7.886	7.996	0.110	1	51	0.309	0.157	0.152-	49-	101	0.234	0.158	0.076-	32-
2	3.943	3.998	0.055	1	52	0.303	0.154	0.150-	49-	102	0.232	0.157	0.075-	32-
3	2.629	2.665	0.037	1	53	0.298	0.151	0.147-	49-	103	0.230	0.155	0.074-	32-
4	1.972	1.999	0.027	1	54	0.292	0.148	0.144-	49-	104	0.227	0.154	0.074-	32-
5	1.577	1.599	0.022	1	55	0.287	0.145	0.141-	49-	105	0.225	0.152	0.073-	32-
6	1.314	1.332	0.018	1	56	0.282	0.143	0.139-	49-	106	0.223	0.151	0.072-	32-
7	1.127	1.142	0.016	1	57	0.277	0.140	0.136-	49-	107	0.221	0.149	0.072-	32-
8	0.986	0.999	0.014	1	58	0.272	0.138	0.134-	49-	108	0.219	0.148	0.071-	32-
9	0.876	0.888	0.012	1	59	0.267	0.136	0.132-	49-	109	0.217	0.147	0.070-	32-
10	0.789	0.800	0.011	1	60	0.263	0.133	0.130-	49-	110	0.215	0.145	0.070-	32-
11	0.717	0.727	0.010	1	61	0.259	0.131	0.127-	49-	111	0.213	0.144	0.069-	32-
12	0.657	0.666	0.009	1	62	0.254	0.129	0.125-	49-	112	0.211	0.143	0.068-	32-
13	0.607	0.615	0.008	1	63	0.250	0.127	0.123-	49-	113	0.209	0.142	0.068-	32-
14	0.563	0.571	0.008	1	64	0.246	0.125	0.122-	49-	114	0.208	0.140	0.067-	32-
15	0.526	0.533	0.007	1	65	0.243	0.123	0.120-	49-	115	0.206	0.139	0.067-	32-
16	0.492	0.500	0.007	1	66	0.239	0.121	0.118-	49-	116	0.204	0.138	0.066-	32-
17	0.464	0.470	0.006	1	67	0.235	0.119	0.116-	49-	117	0.202	0.137	0.066-	32-
18	0.438	0.444	0.006	1	68	0.232	0.118	0.114-	49-	118	0.200	0.136	0.065-	32-
19	0.415	0.421	0.006	1	69	0.229	0.116	0.113-	49-	119	0.199	0.134	0.064-	32-
20	0.394	0.400	0.005	1	70	0.225	0.114	0.111-	49-	120	0.197	0.133	0.064-	32-
21	0.376	0.381	0.005	1	71	0.222	0.113	0.110-	49-	121	0.196	0.132	0.063-	32-
22	0.358	0.363	0.005	1	72	0.219	0.111	0.108-	49-	122	0.194	0.131	0.063-	32-
23	0.343	0.348	0.005	1	73	0.216	0.219	0.003	1	123	0.192	0.130	0.062-	32-
24	0.329	0.333	0.005	1	74	0.213	0.216	0.003	1	124	0.191	0.129	0.062-	32-
25	0.316	0.320	0.004	1	75	0.210	0.213	0.003	1	125	0.189	0.128	0.061-	32-
26	0.303	0.308	0.004	1	76	0.208	0.210	0.003	1	126	0.188	0.127	0.061-	32-
27	0.292	0.296	0.004	1	77	0.205	0.208	0.003	1	127	0.186	0.126	0.060-	32-
28	0.281	0.285	0.004	1	78	0.202	0.205	0.003	1	128	0.185	0.125	0.060-	32-
29	0.272	0.276	0.004	1	79	0.200	0.202	0.003	1	129	0.183	0.124	0.059-	32-
30	0.263	0.267	0.004	1	80	0.197	0.200	0.003	1	130	0.182	0.123	0.059-	32-
31	0.254	0.258	0.004	1	81	0.195	0.197	0.003	1	131	0.181	0.122	0.059-	32-
32	0.246	0.250	0.003	1	82	0.192	0.195	0.003	1	132	0.179	0.121	0.058-	32-
33	0.239	0.242	0.003	1	83	0.190	0.193	0.003	1	133	0.178	0.120	0.058-	32-
34	0.232	0.235	0.003	1	84	0.188	0.190	0.003	1	134	0.177	0.119	0.057-	32-
35	0.225	0.228	0.003	1	85	0.186	0.188	0.003	1	135	0.175	0.118	0.057-	32-
36	0.219	0.222	0.003	1	86	0.183	0.186	0.003	1	136	0.174	0.118	0.056-	32-
37	0.213	0.216	0.003	1	87	0.181	0.184	0.003	1	137	0.173	0.117	0.056-	32-
38	0.206	0.210	0.003	1	88	0.179	0.182	0.002	1	138	0.171	0.116	0.056-	32-
39	0.202	0.205	0.003	1	89	0.177	0.180	0.002	1	139	0.170	0.115	0.055-	32-
40	0.197	0.200	0.003	1	90	0.175	0.178	0.002	1	140	0.169	0.114	0.055-	32-
41	0.192	0.195	0.003	1	91	0.173	0.176	0.002	1	141	0.168	0.113	0.054-	32-
42	0.186	0.190	0.003	1	92	0.171	0.174	0.002	1	142	0.167	0.113	0.054-	32-
43	0.183	0.186	0.003	1	93	0.170	0.172	0.002	1	143	0.165	0.112	0.054-	32-
44	0.179	0.182	0.002	1	94	0.168	0.170	0.002	1	144	0.164	0.111	0.053-	32-
45	0.175	0.178	0.002	1	95	0.166	0.168	0.002	1	145	0.163	0.165	0.002	1
46	0.171	0.174	0.002	1	96	0.164	0.167	0.002	1	146	0.162	0.164	0.002	1
47	0.168	0.170	0.002	1	97	0.163	0.165	0.002	1	147	0.161	0.163	0.002	1
48	0.164	0.167	0.002	1	98	0.161	0.163	0.002	1	148	0.213	0.162	0.051-	24-
49	0.161	0.163	0.002	1	99	0.239	0.162	0.077-	32-	149	0.212	0.161	0.051-	24-
50	0.315	0.160	0.156-	49-	100	0.237	0.160	0.077-	32-	150	0.210	0.160	0.050-	24-

BUS COST ESTIMATING MODEL

BASELINE BUS
UNIT SEATING CAPACITY.... 49 BUS $/MI..... 1.104
DRIVER $/MI..... 5.221 OVERHEAD $/MI..... 1.561
SCENARIO :VANCOUVER/VICTORIA PSL 1981
1ST UNIT SEATING CAPACITY.... 72 2ND UNIT SEATING CAPACITY.... 49
1ST BUS $/MI..... 1.214 2ND BUS $/MI..... 1.104
1ST DRIVER $/MI..... 5.221 2ND DRIVER $/MI..... 5.221
OVERHEAD $/MI..... 1.561

PASS	BASE	TEST	DIFF	%	PASS	BASE	TEST	DIFF	%	PASS	BASE	TEST	DIFF	%
1	7.886	7.996	0.110	1	51	0.309	0.157	0.152-	49-	101	0.234	0.157	0.077-	33-
	3.942	3.997	0.055	1	52	0.303	0.154	0.150-	49-	102	0.232	0.156	0.076-	33-
3	2.629	2.665	0.037	1	53	0.298	0.151	0.147-	49-	103	0.230	0.154	0.075-	33-
4	1.972	1.998	0.027	1	54	0.292	0.148	0.144-	49-	104	0.227	0.153	0.075-	33-
	1.577	1.599	0.022	1	55	0.287	0.145	0.141-	49-	105	0.225	0.151	0.074-	33-
	1.314	1.332	0.018	1	56	0.282	0.143	0.139-	49-	106	0.223	0.150	0.073-	33-
7	1.127	1.142	0.016	1	57	0.277	0.140	0.136-	49-	107	0.221	0.148	0.073-	33-
	0.986	0.999	0.014	1	58	0.272	0.138	0.134-	49-	108	0.219	0.147	0.072-	33-
	0.876	0.888	0.012	1	59	0.267	0.136	0.132-	49-	109	0.217	0.146	0.071-	33-
10	0.788	0.799	0.011	1	60	0.263	0.133	0.130-	49-	110	0.215	0.144	0.071-	33-
11	0.717	0.727	0.010	1	61	0.259	0.131	0.127-	49-	111	0.213	0.143	0.070-	33-
	0.657	0.666	0.009	1	62	0.254	0.129	0.125-	49-	112	0.211	0.142	0.069-	33-
13	0.607	0.615	0.008	1	63	0.250	0.127	0.123-	49-	113	0.209	0.141	0.069-	33-
14	0.563	0.571	0.008	1	64	0.246	0.125	0.122-	49-	114	0.208	0.139	0.068-	33-
	0.526	0.533	0.007	1	65	0.243	0.123	0.120-	49-	115	0.206	0.138	0.068-	33-
	0.493	0.500	0.007	1	66	0.239	0.121	0.118-	49-	116	0.204	0.137	0.067-	33-
17	0.464	0.470	0.006	1	67	0.235	0.119	0.116-	49-	117	0.202	0.136	0.066-	33-
	0.438	0.444	0.006	1	68	0.232	0.118	0.114-	49-	118	0.200	0.135	0.066-	33-
	0.415	0.421	0.006	1	69	0.229	0.116	0.113-	49-	119	0.199	0.133	0.065-	33-
20	0.394	0.400	0.005	1	70	0.225	0.114	0.111-	49-	120	0.197	0.132	0.065-	33-
21	0.375	0.381	0.005	1	71	0.222	0.113	0.110-	49-	121	0.196	0.131	0.064-	33-
	0.358	0.363	0.005	1	72	0.219	0.111	0.108-	49-	122	0.194	0.195	0.001	0
23	0.343	0.348	0.005	1	73	0.216	0.219	0.003	1	123	0.192	0.193	0.001	0
24	0.329	0.333	0.005	1	74	0.213	0.215	0.001	1	124	0.191	0.192	0.001	0
	0.316	0.321	0.004	1	75	0.210	0.212	0.001	1	125	0.189	0.190	0.001	0
	0.303	0.308	0.004	1	76	0.208	0.209	0.001	1	126	0.188	0.189	0.001	0
27	0.292	0.296	0.004	1	77	0.205	0.206	0.001	1	127	0.186	0.187	0.001	0
28	0.282	0.286	0.004	1	78	0.202	0.204	0.001	1	128	0.185	0.186	0.001	0
	0.272	0.276	0.004	1	79	0.200	0.201	0.001	1	129	0.183	0.184	0.001	0
30	0.263	0.267	0.004	1	80	0.197	0.199	0.001	1	130	0.182	0.182	0.001	0
31	0.254	0.258	0.004	1	81	0.195	0.196	0.001	1	131	0.181	0.181	0.001	0
	0.246	0.250	0.003	1	82	0.192	0.194	0.001	1	132	0.179	0.180	0.001	0
33	0.239	0.242	0.003	1	83	0.190	0.191	0.001	1	133	0.178	0.179	0.001	0
34	0.232	0.235	0.003	1	84	0.188	0.189	0.001	1	134	0.177	0.177	0.001	0
	0.225	0.228	0.003	1	85	0.186	0.187	0.001	1	135	0.175	0.176	0.001	0
	0.219	0.222	0.003	1	86	0.183	0.185	0.001	1	136	0.174	0.175	0.001	0
37	0.213	0.216	0.003	1	87	0.181	0.183	0.001	1	137	0.173	0.173	0.001	0
38	0.208	0.210	0.003	1	88	0.179	0.180	0.001	1	138	0.171	0.172	0.001	0
	0.202	0.205	0.003	1	89	0.177	0.178	0.001	1	139	0.170	0.171	0.001	0
40	0.197	0.200	0.003	1	90	0.175	0.176	0.001	1	140	0.169	0.170	0.001	0
41	0.192	0.195	0.003	1	91	0.173	0.175	0.001	1	141	0.168	0.169	0.001	0
	0.188	0.190	0.003	1	92	0.171	0.173	0.001	1	142	0.167	0.167	0.001	0
43	0.183	0.186	0.003	1	93	0.170	0.171	0.001	1	143	0.165	0.166	0.001	0
44	0.179	0.182	0.002	1	94	0.168	0.169	0.001	1	144	0.164	0.165	0.001	0
	0.175	0.178	0.002	1	95	0.166	0.167	0.001	1	145	0.163	0.164	0.001	0
46	0.171	0.174	0.002	1	96	0.164	0.165	0.001	1	146	0.162	0.163	0.001	0
47	0.168	0.170	0.002	1	97	0.163	0.164	0.001	1	147	0.161	0.162	0.001	0
48	0.164	0.167	0.002	1	98	0.161	0.162	0.001	1	148	0.213	0.161	0.053-	25-
	0.161	0.163	0.002	1	99	0.239	0.160	0.079-	33-	149	0.212	0.160	0.052-	25-
50	0.158	0.161	0.002-	1-	100	0.237	0.159	0.078-	33-	150	0.210	0.158	0.052-	25-

POOR

QUALITY

ORIGINAL